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Habitual Physical Activity Behavior of Patients After Primary Total Hip Arthroplasty

Robert Wagenmakers, Martin Stevens, Wiebren Zijlstra, Monique L Jacobs, Inge van den Akker-Scheek, Johan W Groothoff, Sjoerd K Bulstra

Background and Purpose. Despite recognized health benefits of physical activity, little is known about the habitual physical activity behavior of patients after total hip arthroplasty (THA). The purpose of this study was to analyze this behavior and the fulfillment of guidelines for health-enhancing physical activity of these patients compared with a normative population.

Subjects and Methods. The participants were 273 patients who had undergone a primary THA (minimum of 1 year postoperatively). Comparisons were made between this group and 273 age- and sex-matched individuals from a normative population. Comparisons also were made between participants with THA under 65 years of age and those 65 years of age and older and among participants with THA in different Charnley classes. Level of physical activity was assessed with the Short QUestionnaire to ASsess Health-enhancing physical activity (SQUASH).

Results. No significant differences in total amount of physical activity or time spent in different categories of physical activity were found between the THA group and the normative group. Participants with THA spent significantly more minutes in activities of moderate intensity compared with the normative group. Participants with THA who were under 65 years of age were significantly more active than older participants with THA. Charnley class had significant effects on time spent at work, time spent in moderate-intensity activities, and total amount of activity, with the least activity performed by participants in Charnley class C. The guidelines were met by 51.2% of the participants with THA and 48.8% of the normative population. Female participants met the guidelines less frequently than male participants in both the combined groups (odds ratio=0.50, 95% confidence interval=0.35–0.72, $P<.001$) and the THA group (odds ratio=0.48, 95% confidence interval=0.28–0.80, $P=.001$).

Discussion and Conclusion. The results suggest that patients after THA are at least as physically active as a normative population. Nevertheless, a large percentage of these patients do not meet the guidelines; therefore, they need to be stimulated to become more physically active.

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Osteoarthrosis of the hip is one of the most prevalent age-related chronic conditions. It causes a significant impairment in patients' ability to perform activities of daily living and has a high impact on quality of life.[1,2] In cases of advanced osteoarthrosis, total hip arthroplasty (THA) has emerged as a highly successful treatment. As a result, a total of 22,453 primary THAs were performed in the Netherlands in 2005,[3] and 202,500 primary THAs were performed in the United States in 2003.[4] Due to projected growth of the older population and changing thresholds for surgery, these numbers are expected to increase dramatically in the coming decades.[4-7]

The success of THA is determined not only by its cost effectiveness[8-10] and excellent long-term prosthetic survival rates,[11] but above all by its ability to significantly improve the quality of life of patients by relieving pain and improving physical functioning.[12] With respect to physical functioning, the main focus of outcome studies after THA until now has been on the assessment of self-reported physical functioning, using generic and disease-specific outcome instruments such as the Medical Outcome Study 36-Item Short-Form Health Survey (SF-36)[13] and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).[14] These instruments, however, give only information about the limitations that patients experience, not about their level of physical activity.

There is growing awareness in society of the importance of physical activity for general health. Regular physical activity has proven to be effective in the primary and secondary prevention of several chronic conditions and is linked to a reduction in all-cause mortality.[15,16] Regular physical activity also can enhance musculoskeletal fitness, which is positively associated with functional autonomy, mobility, and bone health and negatively associated with the risk for falls.[17,18] These effects on musculoskeletal fitness are particularly important for patients after THA, for whom falls can result in complications with the implanted hip prosthesis, causing a more or less prolonged period of functional dependency.

In the face of these beneficial effects, Dutch and international guidelines have been developed for levels of health-enhancing physical activity. These guidelines originally recommended 30 minutes or more of moderate to intense physical activity 5 days per week, preferably daily.[19,20] Very recently these guidelines were updated, now recommending 30 minutes or more of moderate-intensity aerobic (endurance) physical activity at least 5 days per week or vigorous-intensity aerobic physical activity for a minimum of 20 minutes at least 3 days per week. Combinations of moderate- and vigorous-intensity activity also can be performed to meet the recommendation.[21,22]

Despite these developments, little is known about the habitual physical activity behavior of patients after a THA, and it is unknown to what extent these patients adhere to the guidelines of health-enhancing physical activity. Literature on the topic is scarce and fragmentary and predominantly pertains to sports and walking activities.[23-30] So far, the main focus of these studies of physical activity of patients after THA has been on the determination of realistic loading conditions for hip prostheses and the implications of certain activities for implant survival, as well as on the return to specific activities after THA.

Until now, level of physical activity has been determined only by means of categorical scoring tools such as the 10-point UCLA Activity Score[31] and the 6-point Grimby scale,[32] with a score of 1 on both scales indicating hardly any to no physical activity, a score of 10 on the UCLA Activity Score indicating regular participation in impact sports, and a score of 6 on the Grimby scale indicating regular, vigorous activity. However, these scoring tools do not provide detailed information on duration, frequency, and energy expenditure of activities performed by patients with THA. Bauman et al,[33] in a study of patients with total joint replacements (mean age=66.4 years, SD=9.4), found a mean UCLA Activity Score of 6, corresponding to a moderate-intensity level of physical activity, in 170 patients after primary total THA, at a mean follow-up of 40.7 months. Beaulé et al[34] evaluated 152 patients with THA (mean age=58.7 years, range=21-87) with a mean follow-up of 5.2 years (range=2-21) and found a mean UCLA Activity Score of 6.8. Using the Grimby scale, Chatterji et al,[29] in a study population of 216 patients with THA (mean age=67.8 years, SD=10.2), found a light- to moderate-intensity level of physical activity (mean score=3.46, SD=1.21) 1 to 2 years postoperatively.

As none of these studies provided detailed insight into the habitual physical activity behavior of patients after a primary THA or addressed this behavior within the context of current health-enhancing physical activity recommendations, we conducted an exploratory study into the habitual physical activity behavior of these patients and compared the results with data from a normative population. Additionally, analyses comparing patients with THA younger than 65 years of age with those 65 years of age and over were performed, as well as analyses between patients with and without additional functional impairments.

Table 1.
Main Characteristics of Participants Who Had Undergone Primary Total Hip Arthroplasty (THA) (University Medical Center Groningen, 1998–2003), the Normative Population, and Nonrespondents[a]

Variable	Primary THA (n=273)	Normative Population (n=273)	P[b]	Nonrespondents (n=15)	P[c]
Age (y), mean (SD)	62.7 (13.7)	62.4 (14.1)		60.5 (13.8)	.74
Sex, N (%)					
Male	107 (39.2)	107 (39.2)		5 (33.3)	.43
Female	166 (60.8%)	166 (60.8)		10 (66.7)	
Charnley class, N (%)					
Category A	193 (70.7)			8 (53.3)	.32
Category B	56 (20.4)			2 (13.3)	
Category C	24 (8.8)			5 (33.3)	
Comorbidity, mean (SD)	1.11 (1.16)	1.01 (1.22)	.72	1.07 (0.96)	.56

[a] Student *t* test was used for comparison of continuous variables. Chi-square test was used for comparison of categorical variables. A *P* value of <.05 was considered statistically significant.
[b] *P* value for difference between normative population and participants with primary THA.
[c] *P* value for difference between nonrespondents and participants with primary THA.

Finally, patient fulfillment of Dutch and international guidelines for health-enhancing physical activity, as well as the predictors of fulfillment for these guidelines, were assessed.

Method

Participants

The study sample comprised 371 patients who had undergone a primary THA at University Medical Center Groningen between February 1998 and October 2003 because of primary or secondary osteoarthrosis of the hip. All patients who had undergone a primary THA for these indications during this period were included in the study, with the exception of patients who had died at the time of follow-up. Surgeries were performed by 8 staff surgeons or under direct supervision of one of these staff surgeons. For all patients, the operation had been performed at least 1 year before enrollment in this study (mean=39 months, range=17–78), as 1 year after THA patients were considered to be beyond the recovery phase of the operation. In case of bilateral THAs, the time of follow-up was calculated from the last procedure performed. No bilateral THAs were performed at the same time. A questionnaire and an explanatory letter were sent to all patients. After 3 weeks, a reminder was sent to patients who had not replied by that time. The initial response to the first mailing was 65.2% (n=242), and eventually 73.6% (n=273) of the patients returned their questionnaire, while 7.3% (n=27) responded by telephone or by letter but did not fill in the questionnaire for various reasons and 19.1% (n=71) did not respond at all. Nonresponse analysis did not show any significant differences in main characteristics (age, sex, Charnley class, and comorbidity) between respondents and nonrespondents (Tab. 1).

The normative population was formed by an age- and sex-matched sample of people from the same geographic region as the study population. Data concerning this normative population were collected by the Groningen Municipal Public Health Service as part of a population survey. Every participant with a primary THA was matched with the first-appearing "healthy" counterpart of the same age and sex in the list of individuals in the normative population. Participants were informed in the explanatory letter that return of the completed questionnaire would be regarded as consent to participate.

Instrumentation

Age, sex, general comorbidity, and level of physical activity were assessed by means of a self-administered questionnaire. Preoperative, joint-specific comorbidity of the patients with THA was assessed from their medical records using the Charnley classification.[35] This classification consists of 3 categories: (1) category A denotes a patient with involvement of only one hip and no other condition interfering with physical activity; (2) category B denotes a patient with involvement of both hips but the rest of the body normal and, therefore, not responsible for any defect in the ability to be physically active; and (3) category C denotes a patient with some condition, such as rheumatoid arthritis or hemiplegia,

contributing to failure to achieve normal locomotion.

General comorbidity was assessed with a Dutch version of the 12-item list from Nilsdotter et al.[36] Questions were asked about the presence of 12 comorbid conditions or body areas with problems (heart, hypertension, peripheral arteries, lung, diabetes, neurological problems, cancer, ulcer, kidney disease, vision, back pain, and psychiatric disease). The questions were multiple choice (yes/no/do not know). At the end, a sum score of reported comorbidity was determined for each participant. A score of 0 indicates absence of comorbid conditions and no body areas with problems, and the maximum score of 12 indicates that the patient has all of the assessed conditions and has problems in all of the assessed body areas.

The Short QUestionnaire to ASsess Health-enhancing physical activity (SQUASH)[37] was used to determine amount of physical activity. It measures habitual physical activity level and is structured in a way that allows comparison of the results with Dutch and international physical activity guidelines. Participants were considered to be meeting the guidelines if they spent 30 minutes or more on moderately intense or vigorously intense physical activity at least 5 days a week, as this study was conducted before the updated 2007 guidelines for health-enhancing physical activity were issued.

The SQUASH contains questions on commuting activities, leisure-time and sports activities, household activities, and activities at work and school. It consists of 3 main queries: days per week, average time per day, and intensity (effort). Using the Ainsworth compendium of physical activities,[38] reported activities are assigned a metabolic equivalent (MET) value. One MET is defined as the energy expenditure for sitting quietly, and activities with MET values higher than 1 are defined as having multiples of resting metabolic rate. Subsequently, activities are subdivided into 3 intensity categories: light, moderate, and vigorous. Cutoff points for intensity categories are based on the Dutch physical activity guideline,[20] which is derived from international physical activity guidelines.[19] For adults (aged 54 years and younger), activities with a MET value of 2 to <4 are classified as those of light intensity, activities with a MET value of 4 to <6.5 are classified as those of moderate intensity, and activities with a MET value of ≥ 6.5 are classified as those of vigorous intensity. For older adults (aged 55 years and older), activities with a MET value of 2 to <3 are classified as those of light intensity, activities with a MET value of 3 to <5 are classified as those of moderate intensity, and activities with a MET value of ≥ 5 are classified as those of vigorous intensity. Activities with a MET value lower than 2 are not included because they are considered to contribute negligibly to the habitual activity level. Accounting for the reported effort with which a certain activity is performed, activities then are assigned an intensity score, which is used to calculate an activity score. Activity scores for separate questions are calculated by multiplying total minutes of activity by the intensity score, and the total activity score is calculated by summing the activity scores for separate questions.

The measurement properties of the SQUASH have been assessed in a group of adults (mean age=44 years) by Wendel-Vos et al[37] and recently in our department in a group of older adults (mean age=71 years) after primary THA (unpublished research). In the group of adults in the study by Wendel-Vos et al, Spearman correlations showed an overall reproducibility of .58 for the SQUASH, whereas correlations for the reproducibility of separate questions varied between .44 and .96, with a mean value of .75 ($P<.05$). Using an accelerometer as an activity monitor, the Spearman correlation coefficient between accelerometer readings and total activity score was .45. In our group of older adults after THA, Spearman correlations showed an overall reproducibility of .57, whereas correlations for the reproducibility of separate questions varied between .45 and .90, with a mean value of .61 ($P<.05$). The Spearman correlation coefficient between accelerometer readings and total activity score was .67. These results are in line with those found in other studies of the reproducibility and validity of physical activity questionnaires.[39,40] Therefore, for the purpose of the current study, we considered the SQUASH to be sufficiently reliable and valid to measure the level of physical activity of adults younger than 65 years of age and adults 65 years of age and over.

Data Analysis

Statistical analyses were performed using Statistical Package for the Social Sciences version 12 software.* Descriptive statistics were used to describe the main characteristics of the sample. The Student *t* test was used to compare continuous variables, and the chi-square test was used to compare categorical variables. A Mann-Whitney *U* test was used for comparison of differences in activities of daily living and the intensity of those activities between the THA and normative groups, as well as between participants with THA younger than 65 years of age and those 65 years of age and over. Kruskal-Wallis testing was used to compare these differences in activities and intensities among participants

* SPSS Inc, 233 S Wacker Dr, Chicago, IL 60606.

within different Charnley classes. Differences between the THA and normative groups in meeting the guidelines were assessed with a chi-square test. To gain insight into the predictors of meeting Dutch and international guidelines, a binary logistic regression was used. A P value $<.05$ was considered statistically significant.

Results

The main characteristics of the THA and normative groups are shown in Table 1. The participants in the THA group had a mean age of 62.7 years (SD=13.7), and the individuals in the normative group had a mean age of 62.4 years (SD=14.1). The percentage of women was 60.8% in both groups. There was no significant difference in comorbidity between the groups ($P=.33$).

An overview of physical activities in the daily lives of participants in the THA group and in the normative group is presented in Table 2. Although the total minutes of physical activity was higher in the THA group compared with the normative group, mainly due to the participants with a primary THA spending more time in leisure-time activity, this difference was not significant. There also were no significant differences with respect to the other categories of physical activity between the THA and normative groups. In all groups, most of the physical activity time was spent doing household and leisure activities.

In order to get an impression of the intensity of the physical activities using the previously described cut-off points for intensity categories, activities were subdivided into 3 intensity categories: light, moderate, and vigorous. An overview of the time (in minutes per week) spent in each of the categories is shown in the Figure. The division of activity intensities was almost equal between the THA and normative groups. However, the THA group tended to spend more minutes in activities of light intensity ($P=.20$) and fewer minutes in activities of vigorous intensity ($P=.77$) compared with the normative group, while spending significantly more time in activities of moderate intensity compared with the normative group ($P=.045$).

To assess the potential influence of age or additional functional impairments on physical activity level, subanalyses were performed comparing participants with THA younger than 65 years with those aged 65 years and older, as well as comparing participants with THA in different Charnley classes. The results of the subanalysis comparing the 2 age groups of participants with THA are shown in Table 3. In the older age group, there were significantly more women and the number of comorbidities was significantly higher. In both age groups, most of the time was spent in household and leisure-time activities. Participants in the younger age group also spent a large part of time at work. Compared with the younger age group, the older participants with THA were significantly less active in all types of physical activity, in activities of light and moderate intensity, and in overall physical activity.

Comparison of physical activity among participants with THA in different Charnley classes showed significant differences only in time spent at work, time spent in moderate-intensity activities, and total time spent in physical activity, with the least activity performed by those in Charnley class C (Tab. 4).

Finally, we analyzed to what extent Dutch and international guidelines were met. The percentage of participants after a primary THA who met these guidelines was 51.2% (n=140) compared with 48.8% (n=133) of the normative population. These percentages do not differ significantly ($P=.30$). Additionally, binary logistic regression analysis was used to determine the predictors of meeting Dutch and international guidelines. The dependent variable was meeting the guidelines ("yes" or "no"). The independent variables were age, sex, and total number of comorbidities for the THA and normative groups combined. For the binary logistic regression analysis of the THA group, the Charnley category was added as an independent variable. These independent variables were entered into the analysis because we hypothesized that they could influence the chance of meeting the guidelines. When all of these variables were entered into the regression model, we found that sex was the only variable

Table 2.
Overview of Physical Activities in the Daily Life of Participants Who Had Undergone Primary Total Hip Arthroplasty (THA) (University Medical Center Groningen, 1998–2003) and in the Normative Population[a]

Variable	Primary THA (n=273)	Normative Population (n=273)	P
Activities at work	379.6 (774.5)	349.0 (805.3)	.28
Activities to/from work	28.2 (115.5)	21.2 (130.3)	.74
Household activities	642.6 (813.1)	645.9 (886.5)	.86
Leisure-time activities	550.8 (691.5)	485.6 (808.4)	.08
Sports activities	48.9 (119.5)	62.8 (206.8)	.14
Total	1,601.0 (1,326.8)	1,501.6 (1,528.3)	.09

[a] Mann-Whitney U test was used for comparison of physical activity between groups. A P value of $<.05$ was considered statistically significant. Values are expressed as mean minutes per week (SD).

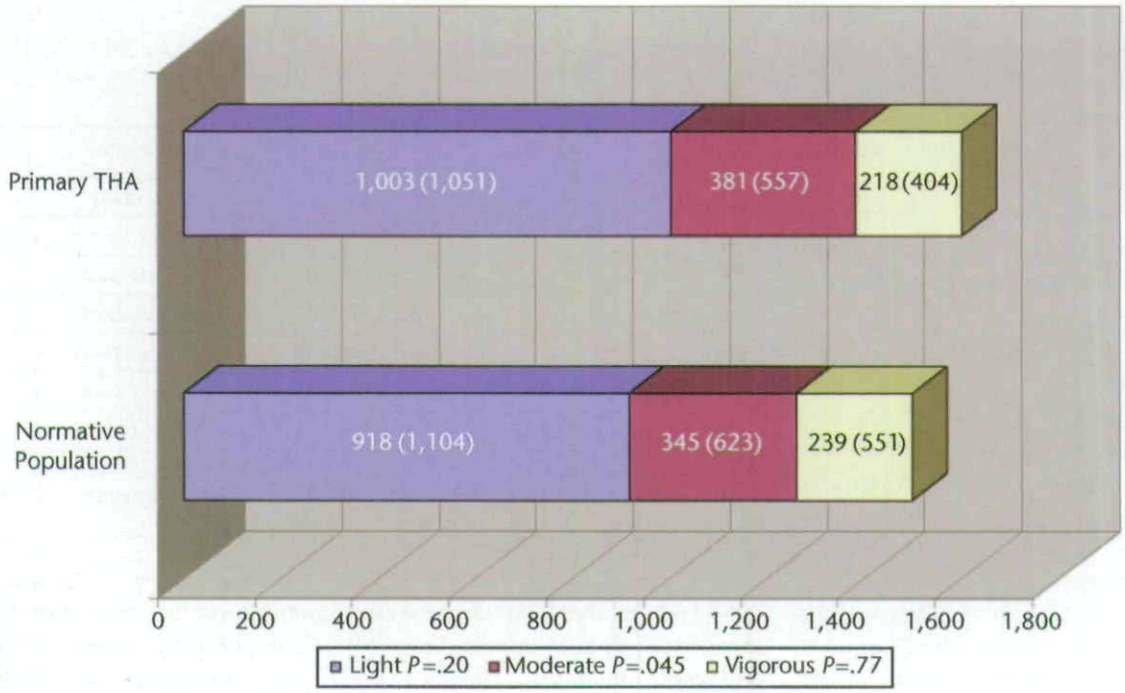

Figure.
Intensity of physical activity performed by participants who had undergone primary total hip arthroplasty (THA) (University Medical Center Groningen, 1998–2003) and a normative population. Values are expressed as minutes per week (SD). A *P* value <.05 was considered statistically significant.

that significantly influenced the chance of meeting Dutch and international guidelines in both the combined groups (odds ratio=0.50, 95% confidence interval=0.35–0.72, $P<.001$) and the TKA group (odds ratio=0.48, 95% confidence interval=0.28–0.80, $P=.001$). The odds of men meeting the guidelines was about twice the odds of women meeting them.

Discussion

Despite the recognized benefits of physical activity on general health, little is known about the habitual physical activity behavior of patients after THA. Therefore, we investigated this behavior by assessing frequency, duration, intensity, and total volume of time spent in several domains of everyday physical activity by patients after primary THA. In this way, the study gives a first impression of the habitual physical activity behavior of these patients. We also assessed the extent to which Dutch and international guidelines of health-enhancing physical activity were met. To our knowledge, this is the first study that systematically examines these aspects of habitual physical activity behavior after THA.

So far, outcome studies of patients who have undergone THA have shown a substantial and long-lasting improvement in health-related quality of life, with physical functioning scores approaching, reaching, or even exceeding population norms.[41–45] Our results showed that, despite having undergone a major surgical procedure, the participants with primary THA reached population norms with respect to level of physical activity. There was even a tendency for the total number of minutes spent in physical activity by the participants with THA to be higher than that of the normative population. This was largely caused by the number of minutes spent in leisure-time activities. Although we were not informed about the preoperative physical activity level of the participants with THA, the surgical procedure did not appear to hamper them in being as physically active as the normative population.

With respect to intensity of physical activity, the participants with THA spent more time in activities of light and moderate intensity than the normative population, while the latter tended to spend more time in vigorous activities. Only the difference in moderate-intensity activities was significant. After a THA, patients are instructed to avoid vigorous activities in order to prevent wear of the hip prosthesis through excessive activity, and—in that sense—this difference in intensity of physical activity should be considered a good and desired effect of the postoperative instructions.

As might be expected, participants with THA younger than 65 years of age were significantly more active than those aged 65 years and older. This result is in line with the findings of previous studies that assessed the walking activity of patients after THA. Patients younger than 60 years of age were found to walk 30% more than those aged 60 years and older.[25,26] In addition, men generally were found to walk more than women. Thus, when interpreting results, it is important to consider the significant differences associated with sex as well as the number of comorbidities between groups, which may have had a confounding effect. Comparison of physical activity between participants with THA in different Charnley classes showed significant differences in total amount of physical activity, time spent in moderate-intensity activity, and time spent at work, with the least activity performed by those in Charnley class C. The participants with THA in Charnley class C, however, tended to be older than those in the other Charnley classes, and there were significant differences in sex among participants with THA in the different Charnley classes, which again might have had confounding effects.

Table 3.
Main Characteristics and Overview of Physical Activities in Daily Life of Participants With Primary Total Hip Arthroplasty (THA) Who Were Younger Than 65 Years of Age and Those Who Were 65 Years of Age and Older (University Medical Center Groningen, 1998–2003)[a]

Variable	Participants <65 y (n=146)	Participants ≥65 y (n=127)	*P*
Age (y), mean (SD)	52.6 (1.0)	74.3 (5.9)	
Sex, N (%)			
Male	70 (47.9)	37 (29.1)	.00*
Female	76 (52.1)	90 (70.9)	
Charnley class, N (%)			
Category A	112 (76.7)	81 (63.8)	.05
Category B	25 (17.1)	31 (24.4)	
Category C	9 (6.2)	15 (11.8)	
Comorbidity, mean (SD)	0.88 (0.99)	1.39 (1.29)	.01*
Activities at work	631.4 (913.5)	90.0 (420.2)	.00*
Activities to/from work	41.8 (115.8)	12.5 (113.5)	.00*
Household activities	730.9 (851.5)	540.9 (757.3)	.02*
Leisure-time activities	647.2 (737.6)	439.9 (618.9)	.00*
Sports activities	57.0 (131.3)	39.5 (104.1)	.09
Activity intensity			
Light	1,346.2 (1,112.8)	607.7 (814.4)	.00*
Moderate	511.2 (670.1)	231.1 (333.6)	.00*
Vigorous	194.0 (334.5)	244.6 (471.1)	.70
Total	2,051.3 (1,338.31)	1,083.4 (1,110.7)	.00*

[a] Student *t* test was used for comparison of continuous variables. Chi-square test was used for comparison of categorical variables. Mann-Whitney *U* test was used for comparison of physical activity between groups. A *P* value <.05 was considered statistically significant (asterisk denotes statistically significant *P* value). Values for activities and activity intensity are expressed as mean minutes per week (SD).

The participants with primary THA met the guidelines of health-enhancing physical activity to the same extent as the normative population. They fulfilled the norm even more frequently than the normative population. Male sex increased the odds of meeting the guidelines.

Although our study is characterized by a high response rate of 73.5% in the group with primary THA, it does have some limitations. To assess level of physical activity, we used a self-administered recall questionnaire. Although self-report instruments continue to be the most widely used type of physical activity measure, allowing collection of data from different domains of physical activity from a large number of people at low costs, there are limitations to their use. Recalling physical activity is a highly complex cognitive task, and instruments can vary in their cognitive demands. Although older adults, in particular, may have memory and recall skill limitations, we have found the measurement properties of the SQUASH in a group of older adults to be identical to those in a group of younger adults (unpublished research). People tend to overestimate their physical activity level.[39]

The cross-sectional design did not allow us to assess the habitual physical activity behavior of the participants with THA preoperatively. It also was not possible to determine the changes in physical activity in the course of time after THA.

Our study presents the physical activity behavior of a group of patients who underwent primary THA in a single university medical center by a single group of surgeons. This may limit the generalizability of these results, and further studies from other hospitals will be needed to gain more insight into the habitual phys-

Table 4.
Main Characteristics and Overview of Physical Activities in Daily Life of Participants Who Had Undergone Primary Total Hip Arthroplasty (THA) in Charnley Classes A, B, and C (University Medical Center Groningen, 1998–2003)

Variable	Charnley Class A (n=193)	Charnley Class B (n=56)	Charnley Class C (n=24)	*P*
Age (y), mean (SD)	61.6 (13.8)	64.08 (13.0)	68.08 (13.7)	.06
Sex, N (%)				
Male	84 (43.5)	19 (33.9)	4 (16.7)	.03*
Female	109 (56.5)	37 (66.1)	20 (83.3)	
Comorbidity, mean (SD)	1.08 (1.08)	1.06 (1.35)	1.5 (1.34)	.16
Activities at work	436.2 (806.3)	306.4 (775.4)	95.0 (322.3)	.04*
Activities to/from work	30.7 (102.2)	31.6 (170.6)	0.00 (0.00)	.10
Household activities	623.5 (748.6)	732.3 (998.5)	586.3 (854.7)	.62
Leisure-time activities	585.5 (709.5)	507.6 (684.8)	372.7 (533.2)	.11
Sports activities	54.8 (131.2)	44.7 (95.6)	10.6 (37.7)	.13
Activity intensity				
Light	1,024.8 (1,012.6)	1,077.1 (1,221.3)	650.8 (881.9)	.19
Moderate	414.5 (587.8)	333.8 (508.9)	220.0 (355.6)	.04*
Vigorous	236.5 (441.2)	167.1 (242.8)	183.1 (390.6)	.29
Total	1,675.8 (1,292.1)	1,578.0 (1,438.88)	1,054.0 (1,223.9)	.04*

[a] Student *t* test was used for comparison of continuous variables. Chi-square test was used for comparison of categorical variables. Kruskal-Wallis test was used for comparison of physical activity between groups. A *P* value <.05 was considered statistically significant (asterisk denotes statistically significant *P* value). Values for activity and activity intensity are expressed as mean minutes per week (SD).

ical activity behavior of patients after THA.

A main advantage of the SQUASH is that it is used nationwide in the Netherlands. Government agencies use it to monitor the physical activity level of the Dutch population. From an international perspective, an alternative for the SQUASH could be the International Physical Assessment Questionnaire (IPAQ).[40] The IPAQ was developed as an instrument for cross-national monitoring of physical activity and inactivity in order to overcome the problem of using diverse physical activity questionnaires, which prevented international comparisons.[39]

In Western societies, there will likely be a steadily increasing demand for primary THA in the coming decades.[4,6] From an individual perspective as well as from a societal perspective, it is important that these patients remain physically active after the procedure, not only to improve their general health but also their ability to live independently. Although our study has shown that patients with primary THA behave like a normative population when it comes to fulfilling guidelines of health-enhancing physical activity, it also showed that a large percentage of these patients are not physically active enough. This finding signifies a need to stimulate such inactive patients to become more physically active. The postoperative rehabilitation phase offers an excellent opportunity to encourage patients to become physically active. In our opinion, more emphasis on the beneficial aspects of physical activity in this group of patients is justified. Based on recommendations for athletic activity after THA, patients should be advised to take part in low-impact, low-contact activities and to avoid high-contact, high-impact activities with sudden, repeated impacts and forced rotation with weight bearing in order to decrease the risk of wear and early loosening of the prosthesis or the occurrence of dislocation or periprosthetic fracture.[46–49]

Conclusions

This study showed that patients after THA appear to be at least as physically active as individuals in the normative population. Although this finding may be considered to be another success of modern THA, it also illustrates that a large number of patients after THA are still insufficiently physically active. In view of the many beneficial effects of regular physical activity, these patients need to be stimulated to become more physically active.

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References

1 Alonso J, Ferrer M, Gandek B, et al. Health-related quality of life associated with chronic conditions in eight countries: results from the International Quality of Life Assessment (IQOLA) project. *Qual Life Res.* 2004;13:283–298.

2 Fautrel B, Hilliquin P, Rozenberg S, et al. Impact of osteoarthritis: results of a nationwide survey of 10,000 patients consulting for OA. *Joint Bone Spine.* 2005; 72:235–240.

3 Prismant. Yeardisk for the hospitals 2005. Available at: http://cognosserver.prismant.nl/cognos7/cgi-bin/ppdscgi.cgi?DC=Q&E=/Prisma-Landelijke-LMR/Landelijke+LMR-informatie+-+Verrichtingen. Accessed December 1, 2007.

4 Kurtz S, Ong K, Lau E, et al. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am.* 2007;89: 780–785.

5 Birrell F, Johnell O, Silman A. Projecting the need for hip replacement over the next decades: influence of changing demography and threshold for surgery. *Ann Rheum Dis.* 1999;58:569–572.

6 Ostendorf M, Johnell O, Malchau H, et al. The epidemiology of total hip replacement in the Netherlands and Sweden: present status and further needs. *Act Orthop Scand.* 2002;73:282–286.

7 Ethgen O, Reginster JY. Degenerative musculoskeletal disease. *Ann Rheum Dis.* 2004; 63:1–3.

8 Chang RW, Pellisier JM, Hazen GB. A cost-effectiveness analysis of total hip arthroplasty for osteoarthritis of the hip. *JAMA.* 1996;275:858–865.

9 Rissanen P, Aro S, Sintonen H, et al. Costs and cost-effectiveness in hip and knee replacements: a prospective study. *Int J Technol Assess Health Care.* 1997;13: 575–588.

10 Garellick G, Malchau H, Herberts P, et al. Life expectancy and cost utility after total hip replacement. *Clin Orthop.* 1998;346: 141–151.

11 Malchau H, Herberts P, Eisler T, et al. The Swedish total hip replacement register. *J Bone Joint Surg Am.* 2002;84(suppl 2):2–20.

12 Etghen O, Bruyère O, Richy F, et al. Health-related quality of life in total hip and total knee arthroplasty: a qualitative and systematic review of the literature. *J Bone Joint Surg Am.* 2004;86:963–974.

13 Ware JE, Sherbourne CD. The MOS 36-Item Short-Form Health Survey (SF-36). *Med Care.* 1992;30:473–483.

14 Bellamy N, Buchanan WW, Goldsmith CH, et al. Validation study of WOMAC: a health status instrument for measuring clinically important patient-relevant outcomes following total hip or knee arthroplasty in osteoarthritis. *J Rheumatol.* 1988;15: 1833–1840.

15 *Physical Activity and Health: A Report of the Surgeon General.* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; 1996: 146–148.

16 Warburton DE, Nicol CW, Bredin SSD. Health benefits of physical activity: the evidence. *CMAJ.* 2006;174:801–809.

17 Warburton DE, Gledhill N, Quinney A. The effects of changes in musculoskeletal fitness on health. *Can J Appl Physiol.* 2001; 26:161–216.

18 Warburton DE, Gledhill N, Quinney A. Musculoskeletal fitness and health. *Can J Appl Physiol.* 2001;26:217–237.

19 Pate PR, Pratt M, Blair SN, et al. Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA.* 1995;273: 402–407.

20 Kemper HGC, Ooijendijk WTM, Stiggelbout M. Consensus about the Dutch physical activity guideline. *Tijdschr Soc Geneeskd.* 2000;78:180–183.

21 Haskell WL, Lee I-M, Pate RR, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc.* 2007;39:1423–1434.

22 Nelson ME, Rejeski WJ, Blair SN, et al. Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. *Circulation.* 2007;116:1094–1105.

23 Visuri T, Honkanen R. Total hip replacement: its influence on spontaneous recreation exercise habits. *Arch Phys Med Rehabil.* 1980;61:325–328.

24 Wallbridge N, Dowson D. The walking activity of patients with artificial hip joints. *Eng Med.* 1982;11:95–96.

25 Schmalzried TP, Szuszczewicz ES, Northfield MR, et al. Quantitative assessment of walking activity after total hip or knee replacement. *J Bone Joint Surg Am.* 1998; 80:54–59.

26 Zahiri CA, Schmalzried TP, Szuszczewicz ES, Amstutz HC. Assessing activity in joint replacement patients. *J Arthroplasty.* 1998; 13:890–895.

27 Morlock M, Schneider E, Bluhm A, et al. Duration and frequency of every day activities in total hip patients. *J Biomech.* 2001;34:873–881.

28 Goldsmith AAJ, Dowson D, Wroblewski BM, et al. Comparative study of the activity of total hip arthroplasty patients and normal subjects. *J Arthroplasty.* 2001;16: 613–619.

29 Chatterji U, Ashworth MJ, Lewis PL, Dobson PJ. Effect of total hip arthroplasty on recreational and sporting activity. *ANZ J Surg.* 2004;74:446–449.

30 Huch K, Müller KAC, Stürmer T, et al. Sports activities 5 years after total knee or hip arthroplasty: the Ulm osteoarthritis study. *Ann Rheum Dis.* 2005;64: 1715–1720.

31 Amstutz HC, Thomas BJ, Jinnah R, et al. Treatment of primary osteoarthritis of the hip: a comparison of total joint and surface replacement arthroplasty. *J Bone Joint Surg Am.* 1984;66:228–241.

32 Grimby G. Physical activity, muscle training in the elderly. *Acta Med Scand.* 1986; 711(suppl):233–237.

33 Bauman S, Williams D, Petrucelli D, et al. Physical activity after total joint replacement: a cross-sectional survey. *Clin J Sports Med.* 2007;17:104–108.

34 Beaulé PE, Dorey FJ, Hoke R, et al. The value of patient activity level in the outcome of total hip arthroplasty. *J Arthroplasty.* 2006;21:547–552.

35 Charnley J. The long-term results of low-friction arthroplasty of the hip performed as a primary intervention. *J Bone Joint Surg Br.* 1972;54:61–76.

36 Nilsdotter AK, Peterson IF, Roos EM, Lohmander LS. Predictors of patient relevant outcome after total hip replacement for osteoarthritis: a prospective study. *Ann Rheum Dis.* 2003;62:923–930.

37 Wendel-Vos GC, Schuit JA, Saris WH, Kromhout D. Reproducibility and relative validity of the Short QUestionnaire to ASsess Health-enhancing physical activity. *J Clin Epidemiol.* 2003;56:1163–1169.

38 Ainsworth BE, Haskell WL, Leon AS, et al. Compendium of physical activities: classification of energy costs of human physical activities. *Med Sci Sports Exerc.* 1993; 25:71–80.

39 Sallis JF, Saelens BE. Assessment of physical activity by self-report: status, limitations, and future directions. *Res Q Exerc Sport.* 2000;71:1–14.

40 Craig CL, Marshall AL, Sjöstrom M, et al. International Physical Activity Questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc.* 2003;35:1381–1395.

41 March LM, Cross MJ, Lapsley H, et al. Outcomes after hip or knee replacement surgery for osteoarthritis: a prospective cohort study comparing patients' quality of life before and after surgery with age-related population norms. *Med J Aust.* 1999;171:235–238.

42 Shields RK, Enloe LJ, Leo KC. Health related quality of life in patients with total hip or knee replacement. *Arch Phys Med Rehabil.* 1999;80:572–579.

43 Soderman P, Malchau H. Is the Harris hip score system useful to study the outcome of total hip replacement? *Clin Orthop Relat Res.* 2001;384:189–197.

44 Nilsdotter AK, Aurell Y, Siosteen AK, et al. Radiographic stage of osteoarthritis or sex of the patient does not predict one year outcome after total hip arthroplasty. *Ann Rheum Dis.* 2001;60:228–232.

45 Kiebzak GM, Campbell M, Mauerhan DR. The SF-36 general health status survey documents the burden of osteoarthritis and the benefits of total joint arthroplasty: but why should we use it? *Am J Manag Care.* 2002;8:463–474.

46 McGrory BJ, Stuart MJ, Sim FH. Participation in sports after hip and knee arthroplasty: review of literature and survey of surgeon preferences. *Mayo Clin Proc.* 1995;70:342–348.

47 Healy WL, Iorio R, Lemos MJ. Athletic activity after joint replacement. *Am J Sports Med.* 2001;29:377–388.

48 Kuster MS. Exercise recommendations after total joint replacement: a review of the current literature and proposal of scientifically based guidelines. *Sports Med.* 2002;32:433–445.

49 Lequesne M, Catonné Y. Total hip arthroplasty: how much physical activity is too much? *Joint Bone Spine.* 2006;73:4–6.

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